

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 June 2002 (13.06.2002)

PCT

(10) International Publication Number
WO 02/47393 A1

(51) International Patent Classification⁷: **H04N 7/24**

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(21) International Application Number: **PCT/EP01/13285**

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(22) International Filing Date:
16 November 2001 (16.11.2001)

(25) Filing Language: English

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI,
SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU,
ZA, ZW.

(26) Publication Language: English

(30) Priority Data:
00/15901 7 December 2000 (07.12.2000) FR

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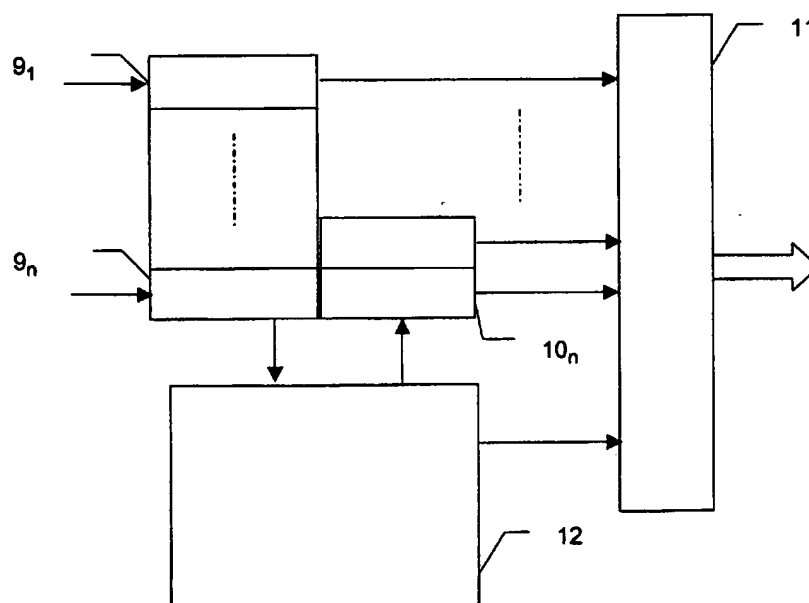
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,
GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent
(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,
NE, SN, TD, TG).

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[Continued on next page]

(54) Title: CODING PROCESS AND DEVICE FOR THE DISPLAYING OF A ZOOMED MPEG2 CODED IMAGE



(57) Abstract: The process is characterized in that, the zoomed image being defined by its horizontal and vertical homothety ratio with respect to the coded image (1, 7), it performs the following steps: calculation of the horizontal and vertical sizes of an initial display rectangle (8) from which would be obtained the sizes of the target display rectangle (2) as defined by the profile and level information by applying the horizontal and vertical homothety ratios; storage in the display horizontal size and display vertical size fields of an MPEG2 video data stream of the horizontal and vertical sizes of the initial display rectangle.



WO 02/47393 A1

**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- entirely in electronic form (except for this front page) and available upon request from the International Bureau

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

CODING PROCESS AND DEVICE FOR THE DISPLAYING OF A ZOOMED MPEG2 CODED IMAGE

The invention relates to a coding and decoding process and
5 device compatible with the MPEG2 standard for displaying a zoom of a
transmitted image. Performing a zoom of an image consists in enlarging or
reducing a part of this image. It therefore involves a modification of the
horizontal and vertical dimensions of the image part selected for display in
zoom mode.

10 Nowadays, applications based on interactivity necessitate the
ability to view images in reduced or magnified form. For example, electronic
program guides utilize images of reduced sizes so as to allow display on the
screen of ancillary information in OSD form (standing for On Screen Display).
Magnification may also be necessary in the case where one wishes to focus
15 the display on a part of the source image.

The process proposed can be used by any type of apparatus
utilizing a stream of data coded according to the MPEG2 standard, for
example a decoder, a DVD reader/recorder, an Internet box, etc. The
transmission of the data may be transmission by satellite, by cable, terrestrial
20 transmission, etc.

MPEG2 compression is not an object-based processing and the
decoded image displayed is generally a copy of the coded source image. To
achieve a specific display in zoom mode, it is therefore necessary to code
the source image such as it must be displayed, that is to say after having
25 performed the zoom on this source image. Thus, the source image,
originating for example from a studio providing a video sequence, is
processed before the coding and transmission of the video data. The zoom
operations are performed on this source image and it is the new "zoomed"
image which is coded like the other images of the video sequence. The
30 drawback of such a process stems from the lack of flexibility which it
imposes. The zooms to be carried out must be decided on at the time of
coding. These zooms can then no longer be modified on receipt of the data,
at the decoder level, for example as a function of data or parameters
selected by the viewer.

35

The aim of the invention is to alleviate the aforesaid drawbacks.

Accordingly, the subject of the invention is a coding process allowing the display of a zoom of an image coded according to the MPEG2 standard, the zoomed image being defined by its horizontal and vertical homothety ratio with respect to the coded image, characterized in that it
5 performs the following steps:

- calculation of the horizontal and vertical sizes of an initial display rectangle from which would be obtained the sizes of the target display rectangle as defined by the profile and level information by applying the horizontal and vertical homothety ratios,
- 10 - storage in the `display_horizontal_size` and `display_vertical_size` fields of an MPEG2 video data stream of the horizontal and vertical sizes of the initial display rectangle.

According to a variant, the zoomed image being defined by its location in the displayed image in the event of a diminishment or by the part of the coded
15 image to be displayed in the event of a magnification, the above process is characterized in that it also performs the following steps:

- calculation of the corresponding position of the centre of the initial display rectangle with respect to the centre of the coded image so as to define a horizontal and vertical offset,
- 20 - storage of an item of information defining the horizontal and vertical offset in the `frame_centre_horizontal_offset` and `frame_centre_vertical_offset` fields of the MPEG2 video data stream.

Its subject is also a coding device for implementing the above coding process, characterized in that it comprises a syntax modifier linked to
25 an MPEG coder for modifying the `display_horizontal_size` and `display_vertical_size` fields and the `frame_centre_horizontal_offset` and `frame_centre_vertical_offset` fields of the MPEG2 data stream originating from the coder, respectively as a function of the amplitude and of the position of the desired zoom.

30 According to a variant, the above device is characterized in that it comprises an application synchronizer linked to the coder and to the syntax modifier for controlling the syntax modification between two temporal code instants `tc0` and `tc1` of the MPEG2 data stream corresponding to the images for which the zoom function is desired.

35 The idea of the invention is to transport a certain number of parameters relating to the zoom of the image in fields defined in the syntax of the binary stream of video data coded according to the video MPEG2

standard. The fields are chosen from among the extensions provided for in the standard. Thus, the coder can dynamically manage the parameters relating to the zoom, that is to say the dimension of the image to be viewed, its location in the image displayed, the part of the coded image to be viewed
5 in zoom mode, doing so without changing the coding parameters such as the horizontal dimension and vertical dimension of the coded image.

The various existing fields, in the video MPEG2 standard (ISO/CEI Standard 13818-2), relating to the size of the images to be coded
10 and to be displayed are recalled hereinbelow:

The dimension of the coded image or more exactly of the displayable image is defined in the sequence header of the MPEG2 data stream (paragraph 6.3.3 of the video MPEG2 standard) and optionally in the sequence extension (paragraph 6.3.5 of the video MPEG2 standard).

15 These are the `horizontal_size`, `vertical_size` fields and the `horizontal_size_value`, `vertical_size_value` and `horizontal_size_extension`, `vertical_size_extension` fields to which the first fields make reference. These fields in fact define the width of the displayable part of the luminance component in pels (pixels) and the height, in terms of number of lines, of the
20 displayable part of the luminance component of the complete image (two-frame) in pels. The displayable image part, which is the image part containing the video and which does not therefore necessarily comprise an integer number of macroblocks, is aligned on the left edge and the upper edge of the coded images.

25 The dimension of the image displayed is, for its part, defined in the `sequence_display_extension` (paragraph 6.3.6 of the video MPEG2 standard). It will be noted that this extension does not define the display procedure. The information of this extension has no relevance to the decoding procedure and can be neglected by the decoders in accordance
30 with the MPEG2 specification. The two structures, `display_horizontal_size` and `display_vertical_size`, together define a rectangle which may be regarded as being the active region of the envisaged display. If this display rectangle is smaller than the coded two-frame image, then the display procedure may be expected to display only a part of this image. Conversely,
35 if the display rectangle is larger than the coded two-frame image, the display procedure may be expected to display the reconstructed two-frame images only on a part rather than the whole of the display device.

The MPEG2 standard envisages a picture_display_extension structure, the subject of paragraph 6.3.12 of the ISO/CEI document 13818-2. The picture_display_extension makes it possible to offset, picture by picture, the position of the display rectangle, whose sizes are specified by the previously described "sequence_display_extension" structure. One application relates to the reframing of images. The frame_centre_horizontal_offset and frame_centre_vertical_offset fields indicate the horizontal and vertical offset of the centre of the reconstructed image with respect to the centre of the display rectangle. The image centre offsets may serve to implement the full-screen reframing process, by which a rectangular zone corresponding to the full screen is defined and is shifted panoramically over the entire reconstructed image. This process is used in particular to go from an image coded in the 16/9 format to an image displayed in the 4/3 format. The zone defined by the 4/3 format can thus contain the most interesting part of the original 16/9 format image.

It will be noted that the fields which are defined in the standard in respect of a sequence (sequence header, sequence display extension) may in fact be transmitted per picture (cf. reserved values in Table 6.2 of the "identification codes for extension triggering codes" standard).

Amplitude of the zoom.

The idea proposed here is to regard the information contained in the "display_horizontal_size" and "display_vertical_size" fields as defining the amplitude of a zoom.

Instead of defining, with the aid of these fields, the dimension of the display rectangle or image displayed, as proposed by the MPEG2 standard, one defines a dimension of an "initial display rectangle" or original image from which the zoom would be performed. The dimension of this initial display rectangle is such that the zoom applied to this rectangle gives an image whose dimensions are those of the target display rectangle, that is to say of the dimension of the screen, as defined by the choice of the profile and level by the coder.

Thus, an initial display rectangle of dimensions greater than those of the target display rectangle corresponds to a diminution of the image and a rectangle of smaller dimensions corresponds to a magnification.

The amplitude of the zoom is therefore obtained by calculating the ratio of the size of the target display rectangle, which is deduced from the level and profile information, to the size of the initial display rectangle, which

is transported in the "display_horizontal_size" and "display_vertical_size" fields. Of course, these latter fields should not be used for the transmission of redundant information concerning the conversion of the 16/9 format into the 4/3 format.

- 5 An exemplary use of the fields described above is given below and shown schematically in Figure 1.

Let us consider a decoded or reconstructed image referenced 1 in the figure, whose dimension is 480 pixels by 576 lines (this is in fact the dimension of the image encoded at the level of the MPEG coder), a target display rectangle or screen dimension referenced 2 of 720 pixels by 576 lines.

The following table indicates the various zoom amplitudes as a function of the information transported in the "display_horizontal_size" and "display_vertical_size" fields.

- 15 The values h_zoom and v_zoom correspond to the horizontal and vertical homotheties. A zoom amplitude of less than 1 means that the dimension of the image obtained relative to the reconstructed image, with respect to the dimension of the coded image, is less than 1 and a zoom amplitude of greater than 1 indicates that the dimension of the image obtained with respect to that of the coded image is greater than 1. If this value is equal to 1, then the image obtained is the reconstructed image.

"Display_horizontal_size" (pixels)	"Display_vertical_size" (lines)	Target display	Amplitude of the zoom h_zoom, v_zoom
1 440	1 152	720 x 576	h_zoom = $720/1\,440 = 0.50$ v_zoom = $576/1\,152 = 0.50$ *Note 1
2 880	2 304	720 x 576	h_zoom = $720/2\,880 = 0.25$ v_zoom = $576/2\,304 = 0.25$ *Note 1
720	576	720 x 576	h_zoom = 1 v_zoom = 1
480	576	720 x 576	h_zoom = $720/480 = 1.50$ v_zoom = $576/576 = 1.00$ * Note 3

360	288	720 x 576	$h_zoom = 720/360 = 2.00$ $v_zoom = 576/288 = 2.00$ *Note 2
180	144	720 x 576	$h_zoom = 720/180 = 4.00$ $v_zoom = 576/144 = 4.00$ *Note 2

Note 1: Diminution of the image

Note 2: Magnification of the image

Note 3: The image obtained from the coded image, the dimensions of which
 5 are greater than those of the coded image, fills the screen.

The target display rectangle (or target display) deduced from the profile and level information and from the image format information (16/9) is greater than the size of the coded image.

10 The images referenced 3, 4, 5, 6 correspond respectively to the values:

$h_zoom = v_zoom = 0.50$

$h_zoom = v_zoom = 1.00$

$h_zoom = 1.50, v_zoom = 1.00$

15 $h_zoom = v_zoom = 2.00$

The display_horizontal_size and display_vertical_size fields are 14-bit fields. The maximum decimal value, equal to 16 383, corresponds to a maximum diminution of 720/16 383 horizontally and 576/16 383 vertically, in
 20 our example.

Location of the zoomed image.

The frame_centre_horizontal_offset and frame_centre_vertical_offset fields of the image display extension structure are utilized to transport the zoomed image location information. Same corresponds to the offset of
 25 the centre of the coded image with respect to the centre of the initial display rectangle.

The centre of the coded image (in fact of the displayable image) is the centre of the region defined by the "horizontal_size" and "vertical_size" fields of the sequence header.

The centre of the initial display rectangle is the centre of the region defined by the "display_horizontal_size" and "display_vertical_size" fields, as indicated above.

5 Figure 2 gives the example of an image diminution and represents an initial display rectangle 8 in which lies the coded image 7 corresponding to the coded image 1. The horizontal and vertical arrows depict the horizontal and vertical offset of the centre of the coded image with respect to the centre of the initial display rectangle.

10 Let us consider for example a decoded or reconstructed image of size 480 pixels × 576 lines, the "display_horizontal_size" and "display_vertical_size" fields respectively transporting the values 1 440 (pixels) and 1 152 (lines) and a size of the target display rectangle of 720 (pixels) × 576 (lines).

15 $h_zoom = 720 / 1\ 440 = 0.50$
 $v_zoom = 576 / 1\ 152 = 0.50$

 If one wishes to position a zoomed image in the upper left part of the initial display rectangle, for example at a distance of 400 pixels horizontally and
20 300 lines vertically, from the upper left corner of the initial display rectangle, the offset information will have the following values:

$frame_centre_horizontal_offset = (400 - 1\ 440 / 2) \times 16$

$frame_centre_vertical_offset = (300 - 1\ 152 / 2) \times 16$

 The two values are negative in accordance with the MPEG norm.

25 The values are multiplied by 16 since the offsets are specified in units of 1/16th of a pel.

 The values 400 and 300 correspond to the pre-zoom values of the image. These values must be corrected for the zoom amplitude if one wishes to define the positioning of the zoomed image in the image actually viewed on
30 the screen.

 In the case of an image magnification, the position of the initial display rectangle (8) in the coded image (7) defines the zone of the magnified coded image which one wishes to view.

35 A particular implementation of the invention relates to the dynamic formatting of the video from an interactive application.

Figure 3 represents a simplified diagram of a device for such an implementation.

The various video source images are received by MPEG2 video coders 9_1 to 9_n . The images are coded according to a constant image dimension, for example 720 pixels by 576 lines. Video syntax modification circuits 10_1 to 10_n which are or are not part of the video coders provide interfaces for modifying fields of the MPEG2 video syntax for the associated coders i to n .

A toolbox for the application 12 is composed of:

- an application injector, for example in the Open TV, Media Highway, Java format, these being registered trade marks,
- an application synchronizer which synchronizes the application with the video for the execution of this application according to the time code information of the MPEG2 elementary stream.

This toolbox 12 receives information originating from the various coders i to n and transmits data for modifying the fields to the syntax modification circuits 10_1 to 10_n .

It is linked to a multiplexing circuit 11 for transmitting private data with their PID (Packet Identifier), in the form of sections.

The various coders 9_1 to 9_n , through the video syntax modification circuits 10_1 to 10_n as the case may be, are also linked to the multiplexing circuit 11 which, on the basis of the various elementary streams and private data, provides a transport stream.

This transport stream is then utilized so as to be transmitted to an IRD receiver (standing for Integrated Receiver/Decoder). This receiver, not represented in the figure, comprises, among other things, a decoder for decoding the audio/video data and an application engine for implementing the application package. It may also be a simple means of digital storage such as a hard disk, DVD or the like for subsequent utilization of the recorded data.

The syntax modification circuit 10 modifies basic fields of the MPEG2 video syntax allowing image zooms to be carried out according to the process described above.

In the video stream, these fields are modified over a time space corresponding to the duration of execution of the application. The time codes relating to the initial and final images between which the application is to be implemented at receiver level are transported by the application (private

data). This is "start time code" information (tc0) and "stop time code" information (tc1) which therefore correspond to the start and to the end of the application. At the receiver, the application engine extracts the "time code" information for the various data streams and the application is triggered, for a given stream, from the reading of the time code corresponding to tc0, up to the instant tc1 where it stops. Between these two instants, the display is performed in zoom mode.

The application synchronizer 12 receives the time codes of the various coders. It modifies, by way of the syntax modification circuits, the fields of the MPEG2 video syntax, between start time code instant which corresponds to the starting of the application and stop time code instant which corresponds to the end of the application, thus making it possible to reduce (or increase) the size of the video image according to the process described above, for images lying between these instants.

This "start time code" and "stop time code" info can originate from outside data. It is, for example, obtained from the identification of an image sequence during which one wishes to be able to perform a zoom, which sequence is defined by way of these time codes.

In one example, the application supplements the displaying of the diminished image with a display in interactive OSD mode, by inserting information into the image. This interactive mode makes it possible to return to the normal mode, by interrupting the application.

Figure 4 represents, on a first line, the image 13 as constructed by the coder between the instants tc0 and tc1 during which the application runs, as well as the images preceding the starting of the application and following the end of the application. On a second line are represented the image 14 as displayed by the decoder when the application runs, the image preceding and the image following the application.

Between the instants tc0 and tc1, the application, at the receiver, runs and reduces the size of the image as a function of the data read from the fields defined above.

The MPEG decoder receives the data stream which it decodes in a conventional manner. In particular, the images for which a zoom operation is possible on account of the filling of the fields relating to the amplitude of the zoom and to the position of the zoomed image are decoded so as to provide firstly a reconstructed image whose size is indicated in the

"horizontal size" and "vertical size" fields. This reconstructed image is then oversampled or undersampled and then filtered as a function of the amplitude of the zoom so as to obtain the dimension of the image which one desires to display. The position of the imagette (diminishment) or the
5 selection of the image part to be viewed (magnification) are calculated as a function of the data relating to the offset.

An exemplary use may be the insertion of an advert. The image dimension is reduced so as to show up some text. Another example relates
10 to a program guide. In the prior art, the viewer makes a choice on an array constructed at the coder level and the selection of an imagette is manifested by zapping to another video service (elementary video stream).

In the invention, the selecting of a program, for example from an OSD display, triggers the starting of the application for the MPEG data
15 stream corresponding to the selected program. The channel selected is then displayed "live" (in real time) in a window.

CLAIMS

5 1 Coding process allowing the display of a zoom of an image coded according to the MPEG2 standard, the zoomed image being defined by its horizontal and vertical homothety ratio with respect to the coded image (1, 7), characterized in that it performs the following steps:

- calculation of the horizontal and vertical sizes of an initial display
10 rectangle (8) from which would be obtained the sizes of the target display rectangle (2) as defined by the profile and level information by applying the horizontal and vertical homothety ratios,
- storage in the display_horizontal_size and display_vertical_size
fields of an MPEG2 video data stream of the horizontal and vertical sizes of
15 the initial display rectangle.

2 Process according to Claim 1, the zoomed image being defined by its location in the displayed image in the event of a diminishment or by the
20 part of the coded image to be displayed in the event of a magnification, characterized in that it performs the following steps:

- calculation of the corresponding position of the centre of the
initial display rectangle (8) with respect to the centre of the coded image (7)
so as to define a horizontal and vertical offset,
- 25 - storage of an item of information defining the horizontal and
vertical offset in the frame_centre_horizontal_offset and
frame_centre_vertical_offset fields of the MPEG2 video data stream.

30 3 Process according to Claim 1, characterized in that the syntax modification of the stream corresponding to the storage of the values in the fields is performed between two temporal code instants tc0 and tc1 of the MPEG2 data stream corresponding to the images for which the zoom
function is desired.

35

4 Coding device for implementing the coding process according to Claim 2, characterized in that it comprises a syntax modifier (12) linked to an MPEG coder (9) for modifying the display_horizontal_size and display_vertical_size fields and the frame_centre_horizontal_offset and frame_centre_vertical_offset fields of the MPEG2 data stream originating from the coder, respectively as a function of the amplitude and of the position of the desired zoom.

5 Device according to Claim 4, characterized in that it comprises an application synchronizer (12) linked to the coder (9) and to the syntax modifier (10) for controlling the syntax modification between two temporal code instants tc0 and tc1 of the MPEG2 data stream corresponding to the images for which the zoom function is desired.

15 6 Process for decoding an MPEG2 data stream, characterized in that it performs the following operations:

- reading of the data in the frame_centre_horizontal_offset and frame_centre_vertical_offset fields of the MPEG2 video data stream,
- reading of the data in the display_horizontal_size and display_vertical_size fields of an MPEG2 video data stream,
- calculation of the homothety ratio of the zoom as a function of the chosen horizontal and vertical sizes of the zoomed image corresponding to these size data,
- oversampling or undersampling or filtering or interpolation of the coded image received as a function of this homothety ratio,
- positioning in the image to be displayed, of the image thus sampled as a function of the data relating to the offset.

7 Receiver comprising a decoder of a stream of MPEG2 data coded according to the process of Claim 3, an interactive application engine, characterized in that the application engine implements the application relating to the zoom function in respect of the images (14) whose temporal codes lie between the values tc0 and tc1.

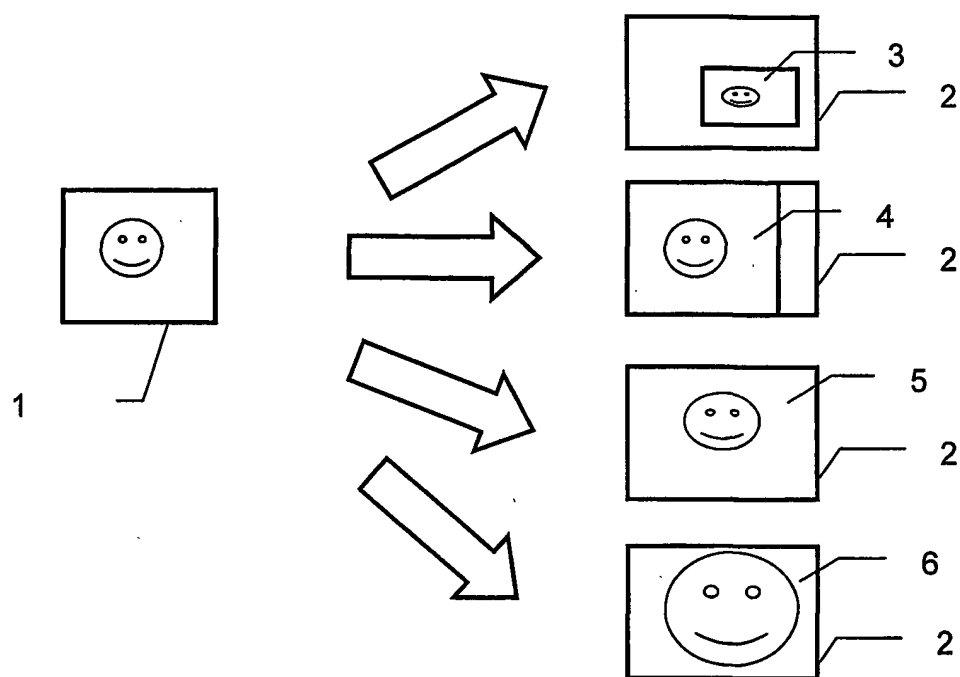


FIG. 1

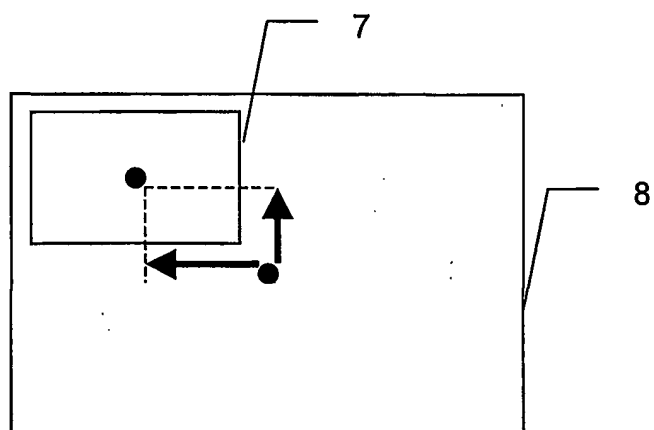


FIG. 2

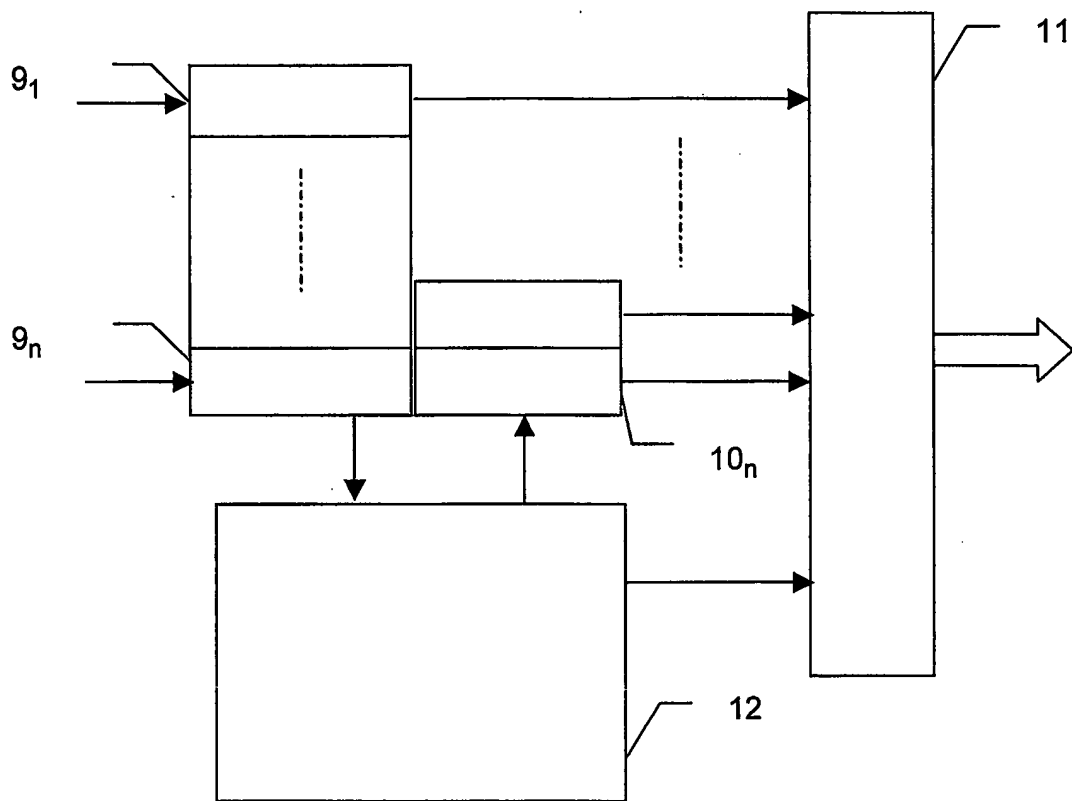


FIG. 3

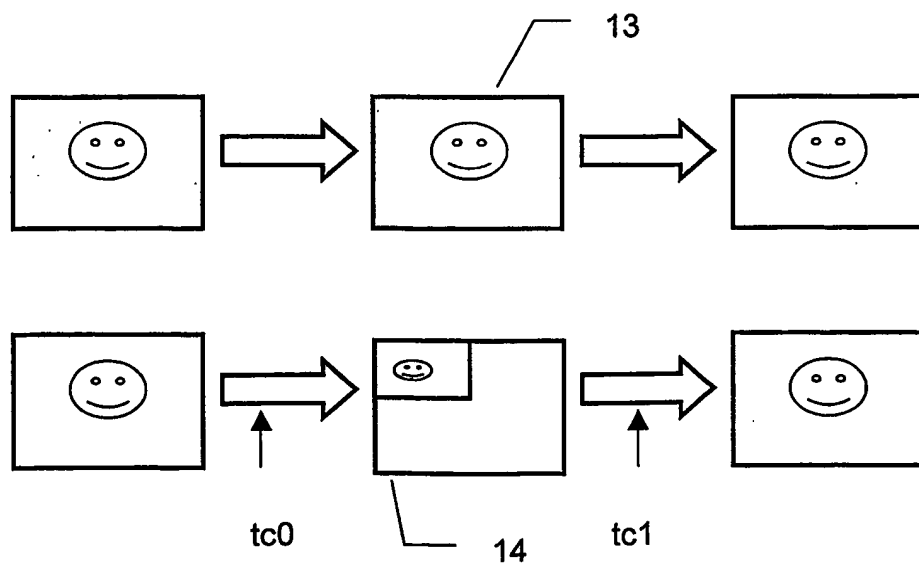


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/13285

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 570 126 A (HOLLENBERG WALTER ET AL) 29 October 1996 (1996-10-29) column 7, line 54 - line 67 ---	1-7
A	EP 0 572 277 A (CANON KK) 1 December 1993 (1993-12-01) page 5, column 7, line 6 -page 7, column 16, line 1 ---	1-7
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 05, 31 May 1996 (1996-05-31) & JP 08 023483 A (MATSUSHITA ELECTRIC IND CO LTD), 23 January 1996 (1996-01-23) abstract -----	1-7



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

11 April 2002

Date of mailing of the international search report

19/04/2002

Name and mailing address of the ISA

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